UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/848,778	05/03/2001	Peter A. Beerel	06666-077001/USC3027	6633

20985 7590 11/16/2004

FISH & RICHARDSON, PC
12390 EL CAMINO REAL
SAN DIEGO, CA 92130-2081

EXAMINER	
TORRES, JOSEPH D	

ART UNIT	PAPER NUMBER
2133	

DATE MAILED: 11/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/848,778	BEEREL ET AL.	
	Examiner	Art Unit	
	Joseph D. Torres	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 July 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19 and 36-102* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19 and 36-102* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *07/06/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings were received on 07/06/2004. These drawings are accepted.

Specification

2. The disclosure is objected to because of the following informalities: The Applicant attempts to define recursive marginalization-combining operations in lines 12-16 on page 6 of the Applicant's disclosure by stating that marginalization-combining operations **"which in various embodiments"** includes max-product operations. In lines 12-16 on page 6 of the Applicant's disclosure, it is not clear what operations the marginalization-combining operations include since it is not clear which embodiments include which operations (Note: form the claim language it is not even clear, if all embodiments of the marginalization-combining operations need to include any of the cited operations), hence the claim contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.
Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 2-7, 19, 38-43 and 63-68 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 2 recites, "marginalization-combining operations". In lines 12-16 on page 6 of the Applicant's disclosure, it is not clear what operations the marginalization-combining operations include since it is not clear which embodiments include which operations (Note: form the claim language it is not even clear, if all embodiments of the marginalization-combining operations need to include any of the cited operations), hence the claim contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 3-7 depend from claim 2, hence inherit the deficiencies of claim 2.

Claims 19, 38 and 63 recite similar language as in claim 2.

Claims 39-43 depend from claim 38, hence inherit the deficiencies of claim 38.

Claims 64-68 depend from claim 63, hence inherit the deficiencies of claim 63.

Claims 1-90 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 1 recites "a tree structure arranged in a parallel prefix and suffix architecture". Nowhere in the specification has the Applicant taught what is meant by "a tree structure arranged in a parallel prefix and suffix architecture".

Claims 1-102 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 1 recites "a parallel prefix and suffix architecture". Nowhere in the specification has the Applicant taught what is meant by "a parallel prefix and suffix architecture". Claims 36, 54, 61, 78, 85 and 91-102 recite similar language as in claim 1.

Response to Arguments

4. Applicant's arguments with respect to claims 1-19 and 36-90 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-8, 10, 11, 13, 16, 17, 19, 36-44, 46, 48, 51, 52, 54, 56, 57, 60-70, 72, 75, 76, 78, 80, 81, 84-87, 89 and 90-102 rejected under 35 U.S.C. 103(a) as being unpatentable over Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA progress Report 42-124, Feb. 15, 1996) in view of Van Stralen; Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen).

35 U.S.C. 103(a) rejection of claim 1, 91 and 92.

Benedetto et al. (hereafter referred to as Benedetto) teaches a decoding method (Figure 2 on page 66 of Benedetto provides a decoding method for a turbo code) comprising: receiving an encoded signal; demodulating the received encoded signal to produce soft information (the Soft Demodulator of Figure 2 on page 66 of Benedetto receives an encoded signal and demodulates the received encoded signal to produce soft information); and iteratively processing the soft information with one or more soft-in/soft-output (SISO) modules, at least one SISO module using a tree structure to compute forward and backward state metrics (Figure 6 on page 79 of Benedetto

teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a trellis, i.e. a tree structure, to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claim 2.

Benedetto teaches the at least one SISO computes the forward and backward state metrics by performing recursive marginalization-combining operations (page 68 of Benedetto teaches forward and backward state metrics and pages 72-73 of Benedetto

teaches recursive marginalization-combining operations; Note: the Applicant defines recursive marginalization-combining operations in lines 12-16 on page 6 of the Applicant's disclosure by stating that marginalization-combining operations may include max-product operations).

35 U.S.C. 103(a) rejection of claims 3, 4, 39, 40, 64 and 65.

Benedetto, substantially teaches the claimed invention described in claims 1, 2 and 36-38 (as rejected above).

However Benedetto, does not explicitly teach the specific use of Min-sum operations.

The Examiner asserts that pages 72-73 of Benedetto teach max-sum operations. The Examiner asserts that since 1/x is a minimum if x is a maximum, use of min-sum operations is an obvious embodiment of the teachings in Benedetto, since the operations are inherently equivalent.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Benedetto and Van Stralen by including use of Min-sum operations. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of Min-sum operations would have provided the opportunity to implement an obvious equivalent embodiment of the teachings in the Benedetto patent since the operations are inherently equivalent.

35 U.S.C. 103(a) rejection of claims 5, 41 and 66.

See equation 21 on page 72 of Benedetto.

35 U.S.C. 103(a) rejection of claim 6.

Equations 29-31 in Benedetto are sum-product operations.

35 U.S.C. 103(a) rejection of claim 7.

Equations 29-31 in Benedetto are max-product operations.

35 U.S.C. 103(a) rejection of claim 8.

The encoded signal is a turbo-encoded signal (see Abstract, Benedetto).

35 U.S.C. 103(a) rejection of claim 10.

Benedetto, substantially teaches the claimed invention described in claims 1-5 (as rejected above).

However Benedetto, does not explicitly teach the specific use of wireless communication.

The Examiner asserts that the decoding devices in Benedetto are communication devices; hence using the decoding devices taught in Benedetto is an obvious embodiment of the teachings in Benedetto since that is what the decoder is designed for.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Benedetto and Van Stralen by including

use of wireless communication. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of wireless communication would have provided the opportunity to implement an obvious embodiment of the teachings in Benedetto for an environment for which it was designed.

35 U.S.C. 103(a) rejection of claim 11.

Figure 10 on page 82 of Benedetto teaches terminating the iterative processing upon occurrence of the predetermined condition of five iterations.

35 U.S.C. 103(a) rejection of claim 13.

Figure 6 on page 79 of Benedetto teaches using soft output of a first SISO as soft input to another SISO.

35 U.S.C. 103(a) rejection of claim 16.

A trellis is a forward-backward tree.

35 U.S.C. 103(a) rejection of claim 17.

Forward/backward recursions on a trellis comprise a tree structure recursion that is bi-directional.

35 U.S.C. 103(a) rejection of claim 19.

Convolutional codes are generated using matrices over a ring and hence form a semi-ring with respect to standard multiplication and addition over the ring (Note: a ring is certainly a semi-ring as well).

35 U.S.C. 103(a) rejection of claims 36, 93 and 94.

Benedetto teaches a method of iterative detection (Figure 2 on page 66 of Benedetto provides an iterative decoding method for a turbo code) comprising: receiving an input signal corresponding to one or more outputs of a finite state machine (FSM, convolutional or the turbo code taught in the Benedetto paper is produced using sequential logic, i.e., an FSM); and determining the soft inverse of the FSM by computing forward and backward state metrics of the received input signal using a tree structure (Figure 6 on page 79 of Benedetto teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a tree structure to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claim 37.

Benedetto teaches that the forward and backward state metrics are computed by at least one soft-in/soft-out SISO module (page 68 of Benedetto teaches forward and backward state metrics).

35 U.S.C. 103(a) rejection of claim 38.

Benedetto teaches that the forward and backward state metrics are computed using a tree-structured set of marginalization-combining operations (page 68 of Benedetto teaches forward and backward state metrics and pages 72-73 of Benedetto teaches recursive marginalization-combining operations; Note: the Applicant defines recursive marginalization-combining operations in lines 12-16 on page 6 of the Applicant's disclosure by stating that marginalization-combining operations may include max-product operations).

35 U.S.C. 103(a) rejection of claim 42.

Equations 29-31 in Benedetto are sum-product operations.

35 U.S.C. 103(a) rejection of claim 43.

Equations 29-31 in Benedetto are max-product operations.

35 U.S.C. 103(a) rejection of claim 44.

The encoded signal is a turbo-encoded signal (see Abstract, Benedetto).

35 U.S.C. 103(a) rejection of claim 46.

Figure 2 on page 66 of Benedetto provides a means for determining the soft inverse of the FSM by iteratively processing soft information.

35 U.S.C. 103(a) rejection of claim 48.

Figure 6 on page 79 of Benedetto teaches using soft output of a first SISO as soft input to another SISO.

35 U.S.C. 103(a) rejection of claim 51.

A trellis is a forward-backward tree.

35 U.S.C. 103(a) rejection of claim 52.

Forward/backward recursions on a trellis comprise a tree structure recursion that is bi-directional.

35 U.S.C. 103(a) rejection of claims 54, 95 and 96.

Benedetto teaches a turbo decoder (Figure 2 on page 66 of Benedetto provides an iterative decoding method for a turbo code) comprising: a demodulator adapted to receive as input a signal encoded by a finite state machine (FSM) and to produce soft information relating to the received signal (the Soft Demodulator of Figure 2 on page 66 of Benedetto receives an encoded signal and demodulates the received encoded signal to produce soft information; Note: convolutional or the turbo code taught in the Benedetto paper is produced using sequential logic, i.e., an FSM); and at least one soft-in/soft-out (SISO) module in communication with the demodulator and adapted to compute a soft-inverse of the FSM using a tree structure (Figure 6 on page 79 of Benedetto teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a tree structure to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen

teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claim 56.

Figure 2 on page 66 of Benedetto provides at least two SISO modules in communication with each other, wherein the SISO modules iteratively exchange soft information estimates of the decoded signal.

35 U.S.C. 103(a) rejection of claim 57.

Benedetto teaches that the forward and backward state metrics are computed by at least one soft-in/soft-out SISO module (page 68 of Benedetto teaches forward and backward state metrics).

35 U.S.C. 103(a) rejection of claim 60.

A trellis is a forward-backward tree.

35 U.S.C. 103(a) rejection of claims 61, 97 and 98.

Benedetto teaches a method of iterative detection (Figure 2 on page 66 of Benedetto provides an iterative decoding method for a turbo code) comprising: receiving an input signal corresponding to output from one or more block encoding modules (the Soft Demodulator of Figure 2 on page 66 of Benedetto receives an input signal corresponding to output from one or more block encoding modules); and determining the soft inverse of the one or more block encoding modules by computing forward and backward state metrics of the received input signal using a tree structure (Figure 6 on page 79 of Benedetto teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a tree structure to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This

modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claim 62.

Benedetto teaches that the forward and backward state metrics are computed by at least one soft-in/soft-out SISO module (page 68 of Benedetto teaches forward and backward state metrics).

35 U.S.C. 103(a) rejection of claim 63.

Benedetto teaches that the forward and backward state metrics are computed using a tree-structured set of marginalization-combining operations (page 68 of Benedetto teaches forward and backward state metrics and pages 72-73 of Benedetto teaches recursive marginalization-combining operations; Note: the Applicant defines recursive marginalization-combining operations in lines 12-16 on page 6 of the Applicant's disclosure by stating that marginalization-combining operations may include max-product operations).

35 U.S.C. 103(a) rejection of claim 67.

Equations 29-31 in Benedetto are sum-product operations.

35 U.S.C. 103(a) rejection of claim 68.

Equations 29-31 in Benedetto are max-product operations.

35 U.S.C. 103(a) rejection of claim 69.

The encoded signal is a turbo-encoded signal (see Abstract, Benedetto).

35 U.S.C. 103(a) rejection of claim 70.

Figure 2 on page 66 of Benedetto provides a means for determining the soft inverse of the FSM by iteratively processing soft information.

35 U.S.C. 103(a) rejection of claim 72.

Figure 6 on page 79 of Benedetto teaches using soft output of a first SISO as soft input to another SISO.

35 U.S.C. 103(a) rejection of claim 75.

A trellis is a forward-backward tree.

35 U.S.C. 103(a) rejection of claim 76.

Forward/backward recursions on a trellis comprise a tree structure recursion that is bi-directional.

35 U.S.C. 103(a) rejection of claims 78, 99 and 100.

Benedetto teaches a block decoder (Figure 2 on page 66 of Benedetto provides an iterative decoding method for a turbo code) comprising: a demodulator adapted to receive as input a signal encoded by a block encoding module and to produce soft information relating to the received signal (the Soft Demodulator of Figure 2 on page 66 of Benedetto receives an encoded signal and demodulates the received encoded signal to produce soft information; Note: convolutional or the turbo code taught in the Benedetto paper is produced using sequential logic, i.e., an FSM); and at least one soft-in/soft-out (SISO) module in communication with the demodulator and adapted to compute a soft-inverse of the block encoding module using a tree structure (Figure 6 on page 79 of Benedetto teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a tree structure to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This

modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claim 80.

Figure 2 on page 66 of Benedetto provides at least two SISO modules in communication with each other, wherein the SISO modules iteratively exchange soft information estimates of the decoded signal.

35 U.S.C. 103(a) rejection of claim 81.

Benedetto teaches that the forward and backward state metrics are computed by at least one soft-in/soft-out SISO module (page 68 of Benedetto teaches forward and backward state metrics).

35 U.S.C. 103(a) rejection of claim 84.

A trellis is a forward-backward tree.

35 U.S.C. 103(a) rejection of claims 85, 101 and 102.

Benedetto teaches an iterative detection method (Figure 2 on page 66 of Benedetto provides an iterative decoding method for a turbo code) comprising: receiving an input signal corresponding to one or more outputs of a module whose soft-inverse can be

computed by running the forward-backward algorithm on a trellis representation of the module (Figure 4 on page 76 of Benedetto teaches receiving an input signal corresponding to one or more outputs of a module whose soft-inverse can be computed by running the forward-backward algorithm on a trellis representation of the module); and determining the soft inverse of the module by computing forward and backward state metrics of the received input signal using a tree structure (Figure 6 on page 79 of Benedetto teaches iteratively processing the soft information with one or more SISO modules, at least one SISO module using a tree structure to compute forward and backward state metrics).

However Benedetto does not explicitly teach the specific use of a tree structure arranged in a parallel prefix and suffix architecture.

Van Stralen, in an analogous art, teaches use of a tree structure arranged in a parallel prefix and suffix architecture (see Figure 5A in Van Stralen). Note: Benedetto teaches turbo decoding but does not teach details of the turbo decoder whereas Van Stralen teaches details of a turbo decoder necessary for the implementation of the decoder in Benedetto.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto with the teachings of Van Stralen by including use of a tree structure arranged in a parallel prefix and suffix architecture. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that

use of a tree structure arranged in a parallel prefix and suffix architecture would have provided the opportunity for high-speed turbo decoding (see Abstract in Van Stralen).

35 U.S.C. 103(a) rejection of claims 86 and 87.

The encoded signal is a turbo-encoded signal (see Abstract, Benedetto).

35 U.S.C. 103(a) rejection of claims 89 and 90.

Convolutional or the turbo code taught in the Benedetto paper is produced using sequential logic, i.e., an FSM. Page 69 of Benedetto teaches block encoding.

6. Claims 9, 45 and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA progress Report 42-124, Feb. 15, 1996) and Van Stralen; Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen) in view of Divsalar et al. (D. Divsalar and F. Pollara, Hybrid Concatenated Codes and Iterative Decoding, TDA progress Report 42-130, August. 15, 1997).

35 U.S.C. 103(a) rejection of claims 9, 45 and 88.

Benedetto and Van Stralen, substantially teaches the claimed invention described in claims 1-8 (as rejected above).

However Benedetto and Van Stralen does not explicitly teach the specific use of a parallel-concatenated convolutional code and a serial concatenated convolutional code. Divsalar et al. (hereafter referred to as Divsalar), in an analogous art, teaches SISO decoding of a parallel-concatenated convolutional code and a serial concatenated convolutional code (see Figure 1 on page 3 of Divsalar). Note Figure 4 on page 11 of Divsalar teaches the obvious modification required for implementing the SISO decoders taught in the Benedetto paper.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto and Van Stralen with the teachings of Divsalar by including an additional step of use of a parallel-concatenated convolutional code and a serial concatenated convolutional code. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a parallel concatenated convolutional code and a serial concatenated convolutional code would have provided the opportunity to implement an obvious embodiment of the teachings in the Benedetto whereby the SISO modules in Benedetto are used in an alternate arrangement.

7. Claims 12, 14, 15, 18, 47, 49, 50, 53, 55, 58, 59, 71, 73, 74, 77, 79, 82 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over Benedetto et al. (S. Benedetto, D. Divsalar, G. Montorsi, and F. Pollara, Soft-Output Decoding Algorithms in Iterative Decoding of Turbo Codes, TDA progress Report 42-124, Feb. 15, 1996) and

Van Stralen; Nick Andrew et al. (US 6304996 B1, hereafter referred to as Van Stralen) in view of Stephen; Karen J. et al. (US 6484283 B2, hereafter referred to as Stephen).

35 U.S.C. 103(a) rejection of claims 12, 14, 15, 47, 49, 50, 58, 59, 71, 73, 74, 82 and 83.

Benedetto and Van Stralen, substantially teaches the claimed invention described in claims 1-11 (as rejected above).

However Benedetto and Van Stralen does not explicitly teach the specific use of parallel prefix or suffix operations.

Stephen, in an analogous art, teaches parallel prefix or suffix operations (See Figure 6 in Stephen; Note: Page 25 of the Applicant's disclosure teaches that prefix or suffix operations are binary operations over a tree structure). One of ordinary skill in the art at the time the invention was made would have been highly motivated to combine the teachings of Benedetto with the teachings in Stephen since Stephen teaches a required means for calculating min* sums (Note: the tree structure of Figure 6 in Stephen teaches a tree structure with latency $O(\log_2 N)$; Note: a Brent-Kung tree is a specific obvious embodiment of the tree structure taught in Stephen).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto and Van Stralen with the teachings of Stephen by including use of parallel prefix or suffix operations. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of parallel prefix

or suffix operations would have provided the opportunity to reduce latency in the calculations (Note: the Applicant has provided Prior Art that explicitly teaches that it was well known in the art at the time the invention was made that the tree structure reduces latency).

35 U.S.C. 103(a) rejection of claims 18, 53, 55, 77 and 79.

Benedetto and Van Stralen, substantially teaches the claimed invention described in claims 1-17 (as rejected above).

However Benedetto and Van Stralen does not explicitly teach the specific use of a sliding window protocol (Note: clam 18 is directed to a specific embodiment of a sliding window protocol).

Stephen, in an analogous art, teaches a sliding window protocol (see Figure 2B in Stephen). One of ordinary skill in the art at the time the invention was made would have been highly motivated to use a sliding window protocol since a sliding window protocol reduces the amount of memory required at the cost of slightly reduced performance (col. 25, lines 53-55, Stephen).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Benedetto and Van Stralen with the teachings of Stephen by including use of a sliding window protocol. This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized that use of a sliding window

protocol would have provided the opportunity to reduce the amount of memory required at the cost of slightly reduced performance (col. 25, lines 53-55, Stephen).

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph D. Torres whose telephone number is (571) 272-3829. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (571) 272-3819. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Joseph D. Torres, PhD
Primary Examiner
Art Unit 2133